

1 Claims

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3 1. A method of identifying an object or structured
4 parts of an object in an image, the method comprising the
5 steps of:

6 creating a set of templates, the set containing a
7 template for each of a number of predetermined object
8 parts and applying said template to an area of interest
9 in an image where it is hypothesised that an object part
10 is present;

11 analysing image pixels in the area of interest to
12 determine the probability that it contains the object
13 part;

14 applying other templates from the set of templates to
15 other areas of interest in the image to determine the
16 probability that said area of interest belongs to a
17 corresponding object part and arranging the templates in
18 a configuration;

19 calculating the likelihood that the configuration
20 represents an object or structured parts of an object;
21 and

22 calculating other configurations and comparing said
23 configurations to determine the configuration that is
24 most likely to represent an object or structured part of
25 an object.

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27 2. A method as claimed in Claim 1 wherein, the
28 probability that an area of interest contains an object
29 part is calculated by calculating a transformation from
30 the co-ordinates of a pixel in the area of interest to
31 the template.

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1 3. A method as claimed in Claim 1 or Claim 2 wherein,
2 analysing the area of interest further comprises
3 identifying the dissimilarity between foreground and
4 background of a transformed probabilistic region.

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6 4. A method as claimed in any preceding claim wherein,
7 analysing the area of interest further comprises
8 calculating a likelihood ratio based on a determination
9 of the dissimilarity between foreground and background
10 features of a transformed template.

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12 5. A method as claimed in any preceding claim wherein,
13 the templates are applied by aligning their centres,
14 orientations in 2D or 3D and scales to the area of
15 interest on the image.

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17 6. A method as claimed in any preceding Claim wherein
18 the template is a probabilistic region mask in which
19 values indicate a probability of finding a pixel
20 corresponding to an object part.

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22 7. A method as claimed in any preceding claim wherein,
23 the probabilistic region mask is estimated by
24 segmentation of training images.

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26 8. A method as claimed in any preceding claim wherein,
27 the image is an unconstrained scene.

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29 9. A method as claimed in any preceding claim wherein,
30 the step of calculating the likelihood that the
31 configuration represents an object or a structured part
32 of an object comprises calculating a likelihood ratio for

1 each object part and calculating the product of said
2 likelihood ratios.

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4 10. A method as claimed in any preceding claim wherein,
5 the step of calculating the likelihood that the
6 configuration represents an object comprises determining
7 the spatial relationship of object part templates.

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9 11. A method as claimed in Claim 10 wherein the step of
10 determining the spatial relationship of the object part
11 templates comprises analysing the configuration to
12 identify common boundaries between pairs of object part
13 templates.

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15 12. A method as claimed in Claim 11 wherein the step of
16 determining the spatial relationship of the object part
17 templates requires identification of object parts having
18 similar characteristics and defining these as a sub-set
19 of the object part templates.

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21 13. A method as claimed in any preceding claim, wherein
22 the step of calculating the likelihood that the
23 configuration represents an object or structured part of
24 an object comprises calculating a link value for object
25 parts which are physically connected.

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27 14. A method as claimed in any preceding claim wherein
28 the step of comparing said configurations comprises
29 iteratively combining the object parts and predicting
30 larger configurations of body parts.

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32 15. A method as claimed in any preceding claim wherein
33 the object is a human or animal body.

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2 16. A system for identifying an object or structured
3 parts of an object in an image, the system comprising:
4 a set of templates, the set containing a template for
5 each of a number of predetermined object parts
6 applicable to an area of interest in an image where it is
7 hypothesised that an object part is present;
8 analysis means for determining the probability that the
9 area of interest contains the object part;
10 configuring means capable of arranging the applied
11 templates in a configuration;
12 calculating means to calculate the likelihood that the
13 configuration represents an object or structured parts of
14 an object for a plurality of configurations; and
15 comparison means to compare configurations so as to
16 determine the configuration that is most likely to
17 represent an object or structured part of an object.
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19 17. A system as claimed in Claim 16 wherein, the system
20 further comprises imaging means capable of providing an
21 image for analysis.

22
23 18. A system as claimed in claim 17 wherein the imaging
24 means is a stills camera or a video camera.

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26 19. A system as claimed in Claims 16 to 18 wherein, the
27 analysis means is provided with means for identifying the
28 dissimilarity between foreground and background of a
29 transformed probabilistic region.

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31 20. A system as claimed in Claims 16 to 19 wherein, the
32 analysis means calculates the probability that an area of
33 interest contains an object part by calculating a

1 transformation from the co-ordinates of a pixel in the
2 area of interest to the template.

3

4 21. A method as claimed in any of Claims 16 to 20
5 wherein, the analysis means calculates a likelihood ratio
6 based on a determination of the dissimilarity between
7 foreground and background features of a transformed
8 template.

9

10 22. A system as claimed in Claims 16 to 21 wherein, the
11 templates are applied by aligning their centres,
12 orientations (in 2D or 3D) and scales to the area of
13 interest on the image.

14

15 23. A system as claimed in any of Claims 16 to 22
16 wherein the template is a probabilistic region mask in
17 which values indicate a probability of finding a pixel
18 corresponding to the body part.

19

20 24. A system as claimed in any of Claims 16 to 22
21 wherein, the probabilistic region mask is estimated by
22 segmentation of training images.

23

24 25. A system as claimed in Claims 16 to 24 wherein, the
25 image is an unconstrained scene.

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27 26. A system as claimed in Claims 16 to 25 wherein, the
28 calculating means calculates a likelihood ratio for each
29 object part and calculating the product of said
30 likelihood ratios.

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32 27. A system as claimed in Claim 26 wherein, the
33 likelihood that the configuration represents an object

1 comprises determining the spatial relationship of object
2 part templates.

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4 28. A system as claimed in Claim 27 wherein the spatial
5 relationship of the object part templates is calculated
6 by analysing the configuration to identify common
7 boundaries between pairs of object part templates.

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9 29. A system as claimed in Claim 28 wherein the spatial
10 relationship of the object part templates is determined
11 by identifying object parts having similar
12 characteristics and defining these as a sub-set of the
13 object part templates.

14

15 30. A system as claimed in any preceding claim, wherein
16 the calculating means is capable of calculating a link
17 value for object parts which are physically connected.

18

19 32. A system as claimed in any of claims 16 to 31
20 wherein the calculating means is capable of iteratively
21 combining the object parts in order to predict larger
22 configurations of body parts.

23

24 33. A method as claimed in Claims 16 to 32 wherein the
25 object is a human or animal body.

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27 34. A computer program comprising program instructions
28 for causing a computer to perform the method of any of
29 Claims 1 to 15.

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31 35. A computer program as claimed in claim 34 wherein
32 the computer program is embodied on a computer readable
33 medium.

1 36. A carrier having thereon a computer program
2 comprising computer implementable instructions for
3 causing a computer to perform the method of any of claims
4 1 to 15.

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6 37. A markerless motion capture system comprising
7 imaging means and a system for identifying an object or
8 structured parts of an object in an image as claimed in
9 any of Claims 16 to 33.

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